UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Crops Research Division
and
AGRICULTURAL MARKETING SERVICE

Preliminary report not for publication[1]

# MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEAT

## 1958 CROP[2]

by

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1/ This is a progress report of cooperative investigations containing data, the interpretation of which may be modified with additional experimentation. Therefore, publication, display, or distribution of any data or any statements herein should not be made without prior written approval of the Crops Research Division, ARS, USDA, and the cooperating agency or agencies concerned.

2/ Cooperative investigations of the Crops Research Division, Agricultural Research Service, and the Grain Division, Agricultural Marketing Service. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring wheat region.

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## INTRODUCTION

Samples of the standard varieties and many of the new strains of hard red spring wheats grown in cooperative experiments in the spring wheat region of the United States 3/ are milled each year by the United States Department of Agriculture and flours baked into bread to determine their quality characteristics.

The baking methods and techniques used on the 1958 crop were essentially the same as those used in similar work for the 1944 to 1957 crops, inclusive.

The purpose of this report is to make available to cooperators the quality data on standard varieties, new strains, and commercial hard red spring wheat from the 1958 crop.

## SOURCE OF SAMPLES

Tests were made on composite and individual samples of the uniform varieties and many other varieties and strains grown in plot experiments at cooperating stations. These included samples grown at Madison, Wis.; Morris, Rosemount, Waseca, and Crookston, Minn.; Edgeley, Fargo, Williston, Langdon, Dickinson, and Minot, N. Dak.; Havre, Moccasin, and Sidney, Mont. Similar tests were made on Eastern and Western composites of the 24 strains of wheat grown in the uniform regional nurseries and on the wheats from the station nurseries in Wisconsin and Montana.

There were also included 25 samples composited from samples of carlot receipts of wheat accumulated during a 90-day period of the 1958 crop movement by the Denver, Minneapolis, Duluth, and Great Falls offices of the Grain Division, Agricultural Marketing Service. These samples represent country-run receipts of the class hard red spring wheat and included only those lots that were graded No. 4 or better under the Official Grain Standards of the United States. These hereafter are referred to as commercial samples. This is the twentieth season that such samples have been collected and tested.

## METHODS USED IN THE CHEMICAL, MILLING, AND BAKING TESTS

For the benefit of the readers who are not familiar with the tests and terminology used in this report, the following terms are explained:

Test weight per bushel was the weight per Winchester bushel and was determined in the laboratory on dockage-free wheat.

3/ Ausemus, E. R. Results on spring wheat varieties grown in cooperative plot and nursery experiments in the spring wheat region in 1958. U. S. Department of Agriculture, Agricultural Research Service, Crops Research Division, CR-5-59, 77 pp. University Farm, St. Paul, Minn. (Processed). January 1959.

Flour yield is the percentage of flour derived from the wheat milled on a Buhler automatic laboratory mill. Ten percent of the low grade flour was discarded, leaving a 90-percent patent flour which was used for the chemical and bread-baking tests. However, the flour yield data in the tables are reported on the basis of a straight grade flour (100 percent) obtained from each sample. Yields are expressed on a moisture-free basis.

Pearling index - The hardness of the grain was determined by pearling 20 grams of dockage-free whole wheat for 1 minute in a model No. 38 Strong-Scott pearler. The amount of material pearled off, expressed as a percentage of the wheat, is called the pearling index. This index has been found useful, not only as a guide in tempering the samples for milling, but also as a measure of the hardness of the grain. A low index figure indicates hard grain and a high index figure indicates soft grain.

Protein content was determined by the standard Kjeldahl procedure using the factor 5.7 to convert nitrogen to protein content. Values are reported on a 14.0 percent moisture basis.

Ash content of flour is a well-recognized but not precise measure of flour refinement. Some strains and varieties of wheat produce flour with low or high ash which appears to be an inherent property of the wheat. Ash content is expressed on a 14.0 percent moisture basis.

Sedimentation value (wheat) was determined by the method described in Cereal Laboratory Methods, Sixth Edition (1957). The sedimentation value is a combined index of gluten content and gluten quality and is, therefore, a rough measure of bread-baking strength. High sedimentation values are normally associated with superior bread-baking strength. Specific sedimentation is the milliliters of sedimentation per gram of protein. The sedimentation value is divided by the flour protein content (both on 14 percent moisture basis).

Mixing time is the optimum time necessary to obtain a dough of maximum consistency in the bread-making process.

Water absorption refers to the optimum amount of water required to bring the dough to the desired standard consistency.

The mixogram curves made for many of the samples provide information on the dough-mixing properties of the flour milled from the strains and varieties. The results of these tests are reported in the tables under the headings of (1) development time and (2) mixing tolerance. The development time is the period required in minutes for a dough to reach the peak or maximum development, or the time needed to develop the dough properly for the best bread. A very rapid curve rise to the peak showing a short development time, and a quick decrease in curve height following the peak, denote a lack of dough stability during mixing. Mixing tolerance is the time in minutes the dough maintains its resistance to mixing with little decline in the height of the mixing curve or pattern. In general, a gradual curve rise with a slow decline (shown as mixing tolerance in the tables) in the curve after reaching the peak indicates a dough of good stability during mixing. The results of the mixogram patterns or curves have been studied, and their significance as relating to the strain or variety is discussed in the text.

The bread-baking tests were made by a formula using 100 grams of flour, 2.0 grams of compressed yeast, 2.0 grams of salt, 5.0 grams of sugar, 0.25 grams of malted wheat flour, 3.0 grams of shortening, 4.0 grams of nonfat-dry milk and varying amounts (0 to 3 mg.) of potassium bromate. The doughs were fermented for 3 hours at 86° F. (30° C.), proofed for 55 minutes at 86° F. (30° C.), and then baked for 25 minutes at 440° F. Loaf-volume data are presented only for those loaves containing that amount of potassium bromate that produced maximum loaf volumes. In most instances the loaf having the greatest volume also had the best grain, texture, and crumb color.

Bread loaf volume must be adequate for the protein content of the flour if the variety is to be considered satisfactory. The loaf volumes are shown in the tables on an "as is" protein basis and, in addition, on an expected loaf volume basis. The expected loaf volume based on flour protein content is the loaf volume obtained from baking experiments in which the flour from 589 samples of 10 hard red spring wheat varieties was tested for the crop years 1944 to 1947. Higher "as is loaf volumes" are generally associated with superior bread-baking strength.

A check or standard flour (12.5 percent protein and 0.47 percent ash on a 14.0 percent moisture basis) was included in the baking trials with each day's test. The average loaf volume of the bread-baking tests made with the standard flour was 834 cc. and the standard error 25.1 cc. On this basis the least significant difference between 2 single bakes is 70 cc.

The quality properties of each variety with respect to crumb grain and color of the bread are shown numerically in the tables. The following scores may be used as an index for judging these two properties:

| | |
|---|---|
| 59 or below | Very poor or unsatisfactory |
| 60 to 69 | Poor or questionable |
| 70 to 79 | Fair |
| 80 to 89 | Good |
| 90 to 99 | Very good |
| 100 and above | Excellent |

Varieties or selections having loaf volumes approximately 125 cc. less than expected, as based on the flour protein content, are questionable; and those having loaf volumes less by approximately 200 cc. or more are unsatisfactory.

An unsatisfactory rating on one or more of the properties would indicate that the variety or strain is generally undesirable for hard wheat milling or bread-making purposes except that a questionable rating on one or more of the quality properties may be balanced by other outstanding properties. The milling properties are discussed in the text and should be considered along with the bread-baking properties.

## EXPERIMENTAL RESULTS

### Station Plot Experiments

The quality data for the uniform varieties and other wheats grown in plots are shown in table 1.

Wisconsin - Wheat samples were received only from Madison.

The varieties and strains have made with one or two exceptions generally satisfactory bread considering the protein content of the wheats. The protein content was low (less than 11.0 percent in the wheat) for a number of the samples. The flour yields were exceptionally high in relation to the test weight per bushel of the grain.

Conley was best among the uniform varieties in quality, considering the data as a whole. Selkirk and Henry were highest of the group in flour yield. Russell was lowest in loaf volume and Henry had the shortest dough-mixing time of the uniform varieties. The dough-mixing properties of Thatcher, Lee, and Conley were strong and elastic.

The dough-mixing properties of Overby's selection were unsatisfactory. The dough-mixing time was short and the dough properties were weak and not as strong as the approved hard red spring wheats. It was one of the lowest in water absorption and similar to Henry for this quality factor. Strain H441B-15-2-2-4 (C.I. 13407) made a better showing quality-wise than the sister selection H441B-15-2-2-3 (C.I. 13406), but the differences between them were not very great. The only questionable property of these two strains was their medium high flour ash content. Both were higher in this respect than the comparably grown Lee and Conley. These results are similar to those for the same strains tested in 1957. C.I. 13407 had the longest dough-mixing time of the two and was slightly the better of the strains in loaf volume. The dough-handling properties of both strains were moderately strong and elastic and milled satisfactorily.

Thatcher$^{6}$ x Kenya Farmer (C.I. 13345) was generally similar to Lee in most quality properties. It was, however, a slightly stronger wheat than Lee in gluten properties considering the flour protein and the loaf volume of the bread. Both made bread of about the same loaf volume, although Thatcher$^{6}$ x Kenya Farmer was 1.3 percent lower in flour protein content than Lee. Strain H305-2 milled satisfactorily, producing a high yield of flour and the dough handling properties were moderately strong and elastic. The loaf volume of the bread was high considering the flour protein content and the grain of the bread was very good.

Minnesota - Samples were received from four Minnesota station, Crookston, Morris, Rosemount, and Waseca. The quality results are discussed to a large extent on a consideration of the data as a whole. The only exception to this is where some variety or strain has shown a particular quality property that should be specifically pointed out.

Table 1.--Yield, milling, baking, and chemical results for hard red spring wheats grown in replicated plots in 1958.

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| **Madison, Wisconsin** | | | | | | | | | | | | | | | | | |
| Henry | 12265 | 60.5 | 32 | 10.9 | 9.7 | 77.5 | .52 | 57 | 1.50 | 3.1 | 2 | 710 | 75 | 85 | 690 | | |
| Thatcher | 10003 | 60.9 | 24 | 12.2 | 11.2 | 73.9 | .58 | 60 | 2.25 | 3.5 | 1 | 735 | 80 | 85 | 765 | | |
| Lee | 12488 | 61.7 | 28 | 13.5 | 12.2 | 74.1 | .54 | 58 | 2.00 | 4.1 | 1 | 743 | 85 | 85 | 815 | | |
| Selkirk | 13100 | 60.3 | 28 | 12.1 | 11.4 | 77.4 | .57 | 61 | 2.25 | 3.7 | 2 | 770 | 80 | 90 | 775 | | |
| Russell | 12484 | 61.1 | 27 | 11.7 | 10.5 | 75.6 | .50 | 60 | 2.50 | 4.3 | 2 | 695 | 75 | 85 | 730 | | |
| Conley | 13157 | 61.3 | 27 | 12.8 | 11.8 | 75.5 | .52 | 64 | 2.75 | 4.3 | 2 | 728 | 85 | 85 | 795 | | |
| H305-2 | | 61.9 | 28 | 11.3 | 10.2 | 76.6 | .51 | 60 | 2.00 | 3.7 | 2 | 768 | 80 | 90 | 715 | | |
| H441B-15-2-2-3 | 13406 | 61.1 | 28 | 11.7 | 10.8 | 73.7 | .57 | 60 | 2.00 | 3.0 | 2 | 695 | 75 | 80 | 745 | | |
| H441B-15-2-2-4 | 13407 | 61.4 | 29 | 12.0 | 11.0 | 73.9 | .59 | 60 | 2.25 | 3.2 | 2 | 733 | 80 | 80 | 755 | | |
| Thatcher[6] x Ken. Farm. | 13345 | 61.2 | 24 | 11.8 | 10.9 | 74.1 | .55 | 61 | 2.00 | 3.6 | 1 | 713 | 80 | 85 | 750 | | |
| Overby | 13346 | 62.4 | 30 | 12.2 | 11.3 | 75.2 | .56 | 57 | 1.75 | 4.0 | 2 | 763 | 85 | 85 | 770 | | |
| **Crookston, Minnesota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 61.2 | 26 | 11.6 | 10.8 | 70.9 | .48 | 58 | 2.00 | 4.4 | 1 | 723 | 75 | 80 | 745 | 4.25 | 5.25 |
| Lee | 12488 | 61.1 | 30 | 12.7 | 12.0 | 69.0 | .50 | 60 | 2.00 | 4.7 | 1 | 748 | 85 | 90 | 805 | 3.25 | 2.75 |
| Selkirk | 13100 | 60.2 | 31 | 11.2 | 10.8 | 74.3 | .50 | 60 | 2.25 | 3.9 | 1 | 728 | 85 | 85 | 745 | 2.75 | 3.00 |
| Conley | 13157 | 60.2 | 29 | 12.0 | 11.1 | 72.1 | .47 | 62 | 2.50 | 4.3 | 2 | 760 | 80 | 80 | 760 | 3.50 | 2.25 |
| Russell | 12484 | 61.7 | 30 | 11.1 | 10.2 | 74.8 | .44 | 58 | 2.50 | 3.8 | 1 | 705 | 80 | 90 | 715 | 3.25 | 3.50 |
| Lee[6] x Ken. Farm. | 13221 | 60.5 | 28 | 12.2 | 11.4 | 69.0 | .49 | 59 | 2.50 | 4.3 | 2 | 718 | 90 | 90 | 775 | 3.50 | 2.50 |
| That.[6] x Ken. Farm. | 13345 | 61.5 | 24 | 11.7 | 10.6 | 69.8 | .46 | 59 | 2.50 | 4.3 | 1 | 705 | 70 | 85 | 735 | 4.00 | 5.75 |
| Overby | 13346 | 62.3 | 33 | 12.3 | 11.5 | 72.1 | .46 | 56 | 1.25 | 3.7 | 1 | 788 | 75 | 95 | 780 | 2.00 | 1.00 |
| Karnvor | 13347 | 61.7 | 27 | 9.8 | 9.2 | 72.4 | .43 | 56 | 1.50 | 3.9 | 2 | 698 | 60 | 85 | 665 | 3.75 | 2.25 |
| Lee x ND 34 | 13322 | 61.3 | 28 | 12.2 | 11.0 | 72.4 | .46 | 58 | 2.50 | 3.8 | 2 | 715 | 85 | 90 | 755 | 3.25 | 1.50 |
| Timstein x Henry | 13405 | 61.0 | 30 | 10.9 | 9.9 | 72.8 | .48 | 59 | 1.75 | 3.9 | 2 | 745 | 80 | 95 | 700 | 2.75 | 1.25 |

Table 1.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| **Morris, Minnesota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 59.8 | 29 | 12.4 | 11.9 | 71.0 | .49 | 61 | 2.25 | 3.4 | 2 | 748 | 75 | 85 | 800 | 4.25 | 4.75 |
| Lee | 12488 | 60.3 | 34 | 14.8 | 13.6 | 70.3 | .43 | 61 | 2.50 | 3.7 | 2 | 843 | 90 | 90 | 885 | 3.50 | 1.50 |
| Selkirk | 13100 | 58.4 | 38 | 13.8 | 13.2 | 75.1 | .45 | 63 | 2.25 | 3.2 | 1 | 880 | 85 | 95 | 865 | 3.25 | 1.50 |
| Conley | 13157 | 60.0 | 32 | 13.5 | 12.7 | 72.0 | .44 | 62 | 2.25 | 3.7 | 2 | 868 | 80 | 90 | 840 | 3.25 | 2.00 |
| Russell | 12484 | 61.1 | 33 | 12.7 | 11.5 | 72.8 | .39 | 61 | 2.50 | 3.9 | 1 | 838 | 85 | 85 | 780 | 3.75 | 2.75 |
| Lee[6] x Ken. Farmer | 13221 | 60.0 | 36 | 14.8 | 13.6 | 72.1 | .51 | 62 | 2.25 | 3.5 | 1 | 915 | 95 | 95 | 885 | 2.75 | 1.00 |
| That.[6] x Ken. Farmer | 13345 | 61.0 | 31 | 12.4 | 11.7 | 74.1 | .53 | 61 | 2.25 | 3.8 | 1 | 780 | 75 | 85 | 790 | 3.25 | 2.50 |
| Overby | 13346 | 61.9 | 38 | 13.8 | 12.8 | 73.2 | .50 | 58 | 1.50 | 3.6 | 1 | 853 | 95 | 95 | 845 | 1.75 | 0.50 |
| Karnvor | 13347 | 59.0 | 29 | 10.8 | 10.1 | 73.1 | .47 | 57 | 1.75 | 4.0 | 1 | 768 | 85 | 95 | 710 | 3.25 | 1.25 |
| Lee x ND 34 | 13322 | 60.1 | 36 | 12.1 | 11.2 | 72.4 | .48 | 61 | 2.00 | 3.2 | 2 | 770 | 80 | 85 | 765 | 3.50 | 1.50 |
| Timstein x Henry | 13405 | 61.2 | 39 | 12.6 | 11.4 | 73.5 | .46 | 60 | 1.50 | 4.6 | 2 | 830 | 85 | 90 | 775 | 2.50 | 1.25 |
| **Rosemount, Minnesota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 56.0 | 24 | 14.1 | 13.4 | 70.1 | .50 | 62 | 2.50 | 4.8 | 1 | 905 | 80 | 95 | 875 | | |
| Lee | 12488 | 59.0 | 29 | 15.4 | 14.6 | 70.6 | .52 | 64 | 3.00 | 4.5 | 1 | 915 | 95 | 100 | 935 | | |
| Selkirk | 13100 | 57.9 | 32 | 14.8 | 13.3 | 75.4 | .49 | 63 | 2.25 | 5.0 | 1 | 945 | 85 | 100 | 870 | | |
| Conley | 13157 | 56.9 | 28 | 14.1 | 13.3 | 73.3 | .48 | 61 | 2.50 | 5.0 | 1 | 833 | 90 | 90 | 870 | | |
| Russell | 12484 | 57.9 | 26 | 12.7 | 11.9 | 73.0 | .47 | 60 | 2.50 | 4.1 | 2 | 828 | 90 | 95 | 800 | | |
| Lee[6] x Ken. Farmer | 13221 | 59.2 | 29 | 15.8 | 14.9 | 69.9 | .54 | 65 | 2.75 | 4.3 | 2 | 905 | 95 | 100 | 950 | | |
| That.[6] x Ken. Farmer | 13345 | 56.5 | 25 | 14.1 | 13.3 | 71.3 | .49 | 62 | 2.50 | 4.7 | 1 | 853 | 75 | 90 | 870 | | |
| Overby | 13346 | 60.8 | 34 | 14.3 | 13.7 | 74.2 | .49 | 57 | 2.00 | 4.5 | 2 | 840 | 80 | 95 | 890 | | |
| Karnvor | 13347 | 56.3 | 29 | 13.9 | 13.2 | 72.1 | .53 | 58 | 2.50 | 5.2 | 1 | 863 | 80 | 90 | 865 | | |

Table 1.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| **Waseca, Minnesota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 58.2 | 29 | 13.2 | 12.4 | 71.3 | .51 | 60 | 2.75 | 4.8 | 2 | 805 | 75 | 95 | 825 | | |
| Lee | 12488 | 58.8 | 34 | 14.5 | 13.5 | 71.4 | .46 | 61 | 2.75 | 4.5 | 2 | 825 | 95 | 95 | 880 | | |
| Selkirk | 13100 | 57.2 | 35 | 13.8 | 13.0 | 75.5 | .47 | 58 | 2.50 | 4.4 | 2 | 828 | 85 | 95 | 855 | | |
| Conley | 13157 | 59.2 | 30 | 12.7 | 12.1 | 74.3 | .47 | 59 | 2.75 | 4.5 | 2 | 788 | 95 | 90 | 810 | | |
| Russell | 12484 | 59.0 | 29 | 11.8 | 10.8 | 72.8 | .44 | 57 | 2.75 | 4.4 | 1 | 763 | 85 | 90 | 745 | | |
| Lee$^6$ x Ken. Farmer | 13221 | 58.9 | 32 | 14.4 | 13.5 | 71.2 | .46 | 57 | 2.25 | 4.4 | 1 | 850 | 90 | 95 | 880 | | |
| Average data for six varieties and strains from four Minnesota stations 1/ | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 58.8 | 27 | 12.8 | 12.1 | 70.8 | .50 | 60 | 2.25 | 4.4 | 2 | 795 | 76 | 89 | 811 | 4.25 | 5.00 |
| Lee | 12488 | 59.8 | 32 | 14.4 | 13.4 | 70.3 | .48 | 62 | 2.56 | 4.4 | 2 | 832 | 91 | 94 | 876 | 3.38 | 2.12 |
| Selkirk | 13100 | 58.4 | 34 | 13.4 | 12.6 | 75.1 | .48 | 61 | 2.31 | 4.1 | 1 | 845 | 85 | 94 | 834 | 3.00 | 2.25 |
| Conley | 13157 | 59.1 | 30 | 13.1 | 12.3 | 72.9 | .46 | 61 | 2.50 | 4.4 | 2 | 812 | 86 | 88 | 820 | 3.38 | 2.12 |
| Russell | 12484 | 59.9 | 30 | 12.1 | 11.1 | 73.4 | .44 | 59 | 2.56 | 4.0 | 1 | 783 | 85 | 90 | 760 | 3.50 | 3.12 |
| Lee$^6$ x Ken. Farmer | 13221 | 59.6 | 32 | 14.2 | 13.3 | 71.3 | .50 | 62 | 2.44 | 4.1 | 2 | 858 | 90 | 92 | 869 | 3.12 | 1.62 |
| **Dickinson, North Dakota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 59.8 | 28 | 14.2 | 13.5 | 65.7 | .48 | 61 | 2.25 | 4.5 | 2 | 860 | 75 | 90 | 880 | | |
| Conley | 13157 | 58.4 | 30 | 15.1 | 14.2 | 62.5 | .48 | 62 | 2.00 | 4.1 | 2 | 890 | 90 | 100 | 915 | | |
| Lee | 12488 | 59.5 | 31 | 15.9 | 15.0 | 60.7 | .46 | 63 | 1.75 | 3.6 | 2 | 898 | 95 | 95 | 955 | | |
| Selkirk | 13100 | 59.0 | 29 | 14.6 | 13.9 | 66.4 | .45 | 62 | 2.00 | 4.5 | 2 | 840 | 80 | 85 | 900 | | |
| Lee x ND 34 | 13322 | 60.6 | 30 | 14.9 | 13.6 | 62.7 | .43 | 62 | 1.75 | 3.9 | 1 | 860 | 95 | 95 | 885 | | |
| That.$^6$ x Ken. Farmer | 13345 | 60.0 | 26 | 14.5 | 13.6 | 65.7 | .44 | 61 | 2.00 | 4.6 | 1 | 840 | 70 | 90 | 885 | | |

1/ Morris, Rosemount, Waseca, and Crookston stations.

Table 1.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| **Edgeley, North Dakota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 60.3 | 28 | 13.4 | 12.4 | 62.1 | .48 | 60 | 2.25 | 5.0 | 2 | 795 | 70 | 90 | 825 | | |
| Conley | 13157 | 60.0 | 28 | 13.5 | 12.6 | 68.3 | .47 | 60 | 2.50 | 5.1 | 2 | 815 | 90 | 100 | 835 | | |
| Lee | 12488 | 61.6 | 31 | 14.4 | 13.5 | 64.9 | .49 | 61 | 2.25 | 4.5 | 1 | 818 | 95 | 100 | 880 | | |
| Selkirk | 13100 | 60.1 | 30 | 13.2 | 12.7 | 68.4 | .49 | 61 | 2.25 | 4.7 | 2 | 785 | 80 | 95 | 840 | | |
| Lee x ND 34 | 13322 | 61.2 | 30 | 13.4 | 12.4 | 65.6 | .48 | 59 | 2.00 | 4.6 | 1 | 795 | 80 | 90 | 825 | | |
| **Fargo, North Dakota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 59.8 | 22 | 10.7 | 9.8 | 63.7 | .57 | 59 | 3.00 | 3.8 | 2 | 693 | 75 | 80 | 695 | | |
| Conley | 13157 | 58.5 | 24 | 11.1 | 10.2 | 66.6 | .53 | 61 | 3.25 | 4.2 | 2 | 705 | 85 | 80 | 715 | | |
| Lee | 12488 | 60.7 | 26 | 10.7 | 10.0 | 65.0 | .50 | 60 | 3.00 | 4.3 | 1 | 683 | 75 | 85 | 705 | | |
| Selkirk | 13100 | 59.7 | 24 | 10.3 | 9.6 | 63.3 | .54 | 59 | 3.00 | 3.7 | 2 | 690 | 75 | 80 | 685 | | |
| Lee x ND 34 | 13322 | 58.8 | 27 | 10.2 | 9.2 | 64.4 | .50 | 58 | 2.50 | 3.1 | 2 | 675 | 70 | 70 | 665 | | |
| R.L. 2936 | | 60.6 | 22 | 10.4 | 9.4 | 63.8 | .54 | 58 | 3.00 | 3.2 | 1 | 640 | 75 | 80 | 675 | | |
| Lee$^{6}$ x Ken. Farmer | 13221 | 61.1 | 25 | 10.6 | 9.6 | 62.7 | .54 | 60 | 2.75 | 3.6 | 1 | 638 | 75 | 75 | 685 | | |
| **Langdon, North Dakota** | | | | | | | | | | | | | | | | | |
| Thatcher | 10003 | 60.5 | 27 | 13.8 | 12.9 | 65.3 | .44 | 62 | 2.25 | 5.3 | 2 | 798 | 75 | 95 | 855 | | |
| Conley | 13157 | 59.7 | 32 | 14.2 | 13.3 | 68.8 | .43 | 61 | 2.75 | 5.1 | 2 | 855 | 85 | 90 | 870 | | |
| Lee | 12488 | 60.7 | 32 | 14.9 | 13.9 | 66.0 | .44 | 63 | 2.50 | 4.8 | 2 | 890 | 95 | 90 | 905 | | |
| Selkirk | 13100 | 59.4 | 31 | 13.5 | 12.8 | 69.5 | .45 | 62 | 2.50 | 5.3 | 2 | 855 | 85 | 90 | 845 | | |
| Lee x ND 34 | 13322 | 60.3 | 32 | 13.7 | 12.9 | 67.7 | .45 | 60 | 2.50 | 5.1 | 2 | 830 | 80 | 80 | 850 | | |

Table 1.—(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| | | | | | | | | Minot, North Dakota | | | | | | | | | |
| Thatcher | 10003 | 62.1 | 27 | 14.6 | 13.4 | 63.8 | .36 | 60 | 1.75 | 4.9 | 1 | 825 | 70 | 85 | 875 | | |
| Conley | 13157 | 61.1 | 31 | 15.3 | 14.1 | 65.2 | .37 | 62 | 1.75 | 4.9 | 2 | 930 | 100 | 100 | 910 | | |
| Lee | 12488 | 61.9 | 31 | 15.9 | 14.6 | 62.0 | .37 | 62 | 1.75 | 5.0 | 1 | 860 | 95 | 95 | 935 | | |
| Selkirk | 13100 | 61.1 | 31 | 14.2 | 13.6 | 69.9 | .40 | 61 | 2.25 | 5.0 | 2 | 820 | 85 | 85 | 885 | | |
| Lee x ND 34 | 13322 | 62.5 | 31 | 14.8 | 13.1 | 62.8 | .36 | 60 | 2.00 | 5.1 | 2 | 815 | 90 | 90 | 860 | | |
| That.$^{6}$ x Ken. Farm. | 13345 | 62.5 | 27 | 14.9 | 13.7 | 64.9 | .37 | 63 | 2.00 | 5.1 | 2 | 820 | 75 | 90 | 890 | | |
| Lee$^{6}$ x Ken. Farm. | 13221 | 61.6 | 30 | 15.6 | 14.4 | 58.8 | .41 | 60 | 2.00 | 4.9 | 2 | 820 | 85 | 100 | 925 | | |
| | | | | | | | | Williston, North Dakota | | | | | | | | | |
| Thatcher | 10003 | 60.9 | 29 | 16.8 | 15.7 | 63.8 | .44 | 61 | 2.25 | 4.5 | 1 | 903 | 75 | 95 | 990 | | |
| Conley | 13157 | 60.0 | 30 | 16.3 | 15.4 | 65.6 | .42 | 63 | 2.25 | 4.7 | 2 | 910 | 85 | 100 | 975 | | |
| Lee | 12488 | 60.3 | 31 | 16.9 | 16.1 | 64.2 | .46 | 63 | 2.50 | 4.4 | 2 | 905 | 90 | 95 | 1010 | | |
| Selkirk | 13100 | 59.2 | 30 | 14.6 | 14.0 | 67.9 | .43 | 64 | 2.50 | 5.1 | 2 | 855 | 80 | 95 | 905 | | |
| Lee x ND 34 | 13322 | 60.6 | 32 | 16.4 | 15.5 | 62.1 | .42 | 63 | 2.25 | 4.5 | 2 | 890 | 90 | 90 | 980 | | |
| Karnvor | 13347 | 59.3 | 31 | 16.5 | 15.8 | 65.3 | .42 | 61 | 2.25 | 4.6 | 2 | 960 | 80 | 90 | 995 | | |
| | | | | | | | | Average data for five varieties and strains from six North Dakota stations 1/ | | | | | | | | | |
| Thatcher | 10003 | 60.5 | 27 | 13.9 | 13.0 | 64.0 | .46 | 60 | 2.29 | 4.7 | 2 | 812 | 73 | 89 | 853 | | |
| Lee | 12488 | 60.8 | 30 | 14.8 | 13.8 | 63.8 | .45 | 62 | 2.29 | 4.4 | 2 | 842 | 91 | 93 | 898 | | |
| Selkirk | 13100 | 59.8 | 29 | 13.4 | 12.8 | 67.6 | .46 | 62 | 2.42 | 4.7 | 2 | 808 | 80 | 88 | 843 | | |
| Conley | 13157 | 59.6 | 29 | 14.2 | 13.3 | 66.2 | .45 | 62 | 2.42 | 4.7 | 2 | 849 | 89 | 95 | 870 | | |
| Lee x ND 34 | 13322 | 60.7 | 30 | 13.9 | 12.8 | 64.2 | .44 | 60 | 2.17 | 4.4 | 2 | 811 | 84 | 86 | 844 | | |

1/ Fargo, Williston, Langdon, Dickinson, Minot, and Edgeley stations.

Table 1.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| | | | | | | Havre, Montana | | | | | | | | | |
| Thatcher | 10003 | 61.1 | 30 | 15.6 | 14.7 | 64.1 | .42 | 61 | 1.75 | 4.6 | 1 | 795 | 80 | 95 | 940 |
| Conley | 13157 | 60.4 | 32 | 15.7 | 14.9 | 66.9 | .41 | 62 | 2.25 | 4.6 | 1 | 850 | 80 | 95 | 950 |
| Lee | 12488 | 61.5 | 32 | 16.0 | 14.9 | 63.1 | .41 | 63 | 2.50 | 4.8 | 2 | 798 | 80 | 95 | 950 |
| Selkirk | 13100 | 60.1 | 32 | 14.9 | 14.2 | 70.3 | .43 | 63 | 2.25 | 4.6 | 1 | 770 | 85 | 95 | 915 |
| | | | | | | Moccasin, Montana | | | | | | | | | |
| Thatcher | 10003 | 59.7 | 28 | 16.4 | 15.4 | 63.9 | .44 | 63 | 2.00 | 4.4 | 2 | 900 | 80 | 90 | 975 |
| Conley | 13157 | 57.3 | 32 | 16.7 | 16.1 | 66.8 | .42 | 66 | 2.50 | 4.4 | 2 | 950 | 75 | 85 | 1010 |
| Lee | 12488 | 59.8 | 32 | 16.6 | 15.6 | 60.9 | .42 | 65 | 2.50 | 4.4 | 2 | 903 | 90 | 100 | 985 |
| Selkirk | 13100 | 58.7 | 31 | 15.5 | 14.5 | 67.9 | .42 | 63 | 2.50 | 4.7 | 2 | 870 | 80 | 100 | 930 |
| | | | | | | Sidney, Montana | | | | | | | | | |
| Thatcher | 10003 | 60.3 | 30 | 14.4 | 13.8 | 65.1 | .38 | 63 | 2.50 | 5.0 | 1 | 880 | 75 | 95 | 895 |
| Conley | 13157 | 59.0 | 34 | 14.8 | 13.9 | 64.4 | .40 | 63 | 2.25 | 5.1 | 2 | 890 | 85 | 100 | 900 |
| Lee | 12488 | 60.4 | 34 | 15.5 | 14.2 | 59.7 | .35 | 64 | 2.25 | 4.8 | 2 | 885 | 100 | 95 | 915 |
| Selkirk | 13100 | 59.5 | 35 | 14.1 | 13.3 | 69.2 | .38 | 65 | 2.25 | 5.2 | 2 | 830 | 95 | 90 | 870 |
| | | | | | | Average data for four varieties from three Montana stations 1/ | | | | | | | | | |
| Thatcher | 10003 | 60.4 | 29 | 15.5 | 14.6 | 64.4 | .41 | 62 | 2.08 | 4.7 | 1 | 858 | 78 | 93 | 937 |
| Lee | 12488 | 60.6 | 33 | 16.0 | 14.9 | 61.2 | .39 | 64 | 2.42 | 4.7 | 2 | 862 | 90 | 97 | 950 |
| Selkirk | 13100 | 59.4 | 33 | 14.8 | 14.0 | 69.1 | .41 | 64 | 2.33 | 4.8 | 2 | 823 | 87 | 95 | 905 |
| Conley | 13157 | 58.9 | 33 | 15.7 | 15.0 | 66.0 | .41 | 64 | 2.33 | 4.7 | 2 | 897 | 80 | 93 | 953 |

1/ Havre, Moccasin and Sidney stations.

The samples from Rosemount compared by variety were slightly higher in flour protein content than those received from Morris and Waseca and were from 1.7 percent to 4.0 percent higher than the same varieties grown at Crookston. This, in part, accounts for the variations in loaf volume of the bread made from the same variety grown at the different stations. The Crookston samples produced bread with lower loaf volumes and slightly lower grain scores. There were some variations in the water absorptions of the samples with the Rosemount and Morris samples being slightly higher, in general, than the absorptions for the Waseca and Crookston samples.

Most of the samples milled satisfactorily with the exception of the variety Lee from both Crookston and Rosemount stations and strain Lee$^{6}$ x Kenya Farmer (C.I. 13221) from Rosemount. These had only fair milling properties because of their slow sieving or bolting properties.

Thatcher, Lee, Selkirk, and Conley were the strongest of the varieties in dough-handling properties with strains Lee$^{6}$ x Kenya Farmer (C.T. 231, C. I. 13221) and Thatcher$^{6}$ x Kenya Farmer (C.T. 233, C.I. 13345) being slightly stronger than Russell, Overby, Karnvor, and the other strains tested. The flour yields obtained were within the range expected from approved hard red spring wheats with Selkirk the highest and Lee and Lee$^{6}$ x Kenya Farmer the lowest by a slight margin. In general, the wheats received from the Morris station had slightly higher pearling index values than the same varieties grown at the other three Minnesota stations.

Overby in particular, grown at 3 of the 4 stations had a high pearling index value (indicating soft texture) and had relatively low water absorption. It was one of the better varieties in protein content at the Morris and Rosemount stations. These quality factors combined with a short mixing time and very short mixing tolerance, as shown by the mixograms, make this a questionable variety. However, in spite of all these undesirable characteristics, the bread made with the flour had good loaf volume and grain characteristics.

Karnvor had good test weight per bushel, relatively high flour yield, a low pearling index value and low flour ash content but generally had below average protein content, mixing time, and loaf volume. This variety appears to be quite satisfactory from the results obtained on the sample grown at the Rosemount station, but did not seem to be of equal or satisfactory quality when grown at the Morris and Crookston stations.

Lee x ND 34 (C.I. 13322) compared favorably with Selkirk and Conley and in some respects was slightly better than Thatcher when grown at Crookston, but did not appear to be of equal quality when grown at the Morris station.

Timstein x Henry (C.I. 13405) was grown at only two of the stations, Morris and Crookston. Due to the fact that nearly all of the wheats grown at Crookston were of poorer quality than those grown at the other three stations, only general conclusions are made about this strain. In general, the pearling index value was high at Morris, and protein content rather low at Crookston. However, the test weight, flour yield, ash content, water absorption, and bromate response were satisfactory and in spite of low flour protein content and short mixing time the bread had good loaf volume and grain characteristics.

Karnvor had good test weight per bushel, relatively high flour yield, a low pearling index value and low flour ash content but generally had below average protein content, mixing time, and loaf volume. This variety appears to be quite satisfactory from the results obtained on the sample grown at the Rosemount station, but did not seem to be of equal or satisfactory quality when grown at the Morris and Crookston stations.

Lee x ND 34 (C.I. 13322) compared favorably with Selkirk and Conley and in some respects was slightly better than Thatcher when grown at Crookston, but did not appear to be of equal quality when grown at the Morris station.

Timstein x Henry (C.I. 13405) was grown at only two of the stations, Morris and Crookston. Due to the fact that nearly all of the wheats grown at Crookston were of poorer quality than those grown at the other three stations, only general conclusions are made about this strain. In general, the pearling index value was high at Morris, and protein content rather low at Crookston. However, the test weight, flour yield, ash content, water absorption and bromate response were satisfactory and in spite of low flour protein content and short mixing time the bread had good loaf volume and grain characteristics.

Thatcher$^{6}$ x Kenya Farmer seems to be generally similar to Thatcher in nearly all the quality factors with the exception of slightly higher ash content in the sample received from Morris.

Mixogram curves were made on the samples from Morris and Crookston stations. According to the mixograms, Lee x ND 34 (C.I. 13322) and Timstein x Henry (C.I. 13405) had average mixing or development times but both had short mixing tolerances, an undesirable property, indicating poor stability to mixing. Overby had both a short mixing time and a very short mixing tolerance which would indicate that this variety, by itself, shows very little promise of meeting the requirements for a good bread-making flour. The short mixing or development time is a very desirable factor but is secondary to a strong or long mixing tolerance.

Thatcher$^{6}$ x Kenya Farmer had the strongest mixing properties of the strains and crosses tested in this group.

Thatcher, Lee, Selkirk, Conley, and Russell showed average or better mixing characteristics with Thatcher perhaps strongest of the varieties tested.

North Dakota - Wheat samples were received from Edgeley, Fargo, Williston, Langdon, Dickinson, and Minot, North Dakota. The samples from Fargo were 3 to 6 percent lower in protein content than those received from the other 5 stations. All approved hard red spring varieties had moderately strong to very strong dough properties and made generally satisfactory bread. The exceptions were the Fargo samples which produced short, weak doughs that had questionable dough-handling properties and produced bread with low loaf volumes and poor crumb color and grain. However, these loaf volumes were nearly equal to the volumes expected from any given flour of the same protein content. The Fargo samples produced flours with rather high ash content.

Lee x ND 34 (ND 81) had a test weight, flour yield, pearling index wheat and flour protein content, and ash content similar to Thatcher and Lee in most instances. It was not, however, as strong as Conley in some respects. This strain made satisfactory bread with good loaf volume, crumb color, and grain except for the Fargo sample. It appears to be a promising bread wheat.

R.L. 2936 received from only the Fargo station had good test weight, flour yield, ash content, and mixing time. Protein content, water absorption, loaf volume, and crumb color and grain were rather low but this was the general pattern with all the Fargo samples. In many respects this strain was a little below the level of the three approved hard red spring varieties grown at this station but was similar to Selkirk.

Lee$^{6}$ x Kenya Farmer (C.I. 13221) was received from two stations, Fargo and Minot, making it difficult because of so few samples to make definite comparisons or evaluations. This strain when grown at Minot gave the lowest flour yield of all the samples tested this year from the North Dakota plots. However, when grown at Fargo, the sample gave a flour yield comparable to that of the known varieties when all North Dakota station results were considered. This was true for most of the other quality characteristics also.

Thatcher$^{6}$ x Kenya Farmer (C.I. 13345) was grown at Dickinson and Minot and appears to be a good bread wheat with satisfactory quality characteristics except for a slight yellowness in crumb color. It was similar in most respects to comparably grown approved hard red spring wheats.

Montana - Samples were received from Havre, Moccasin, and Sidney, Montana. The four approved varieties, Thatcher, Conley, Lee, and Selkirk, were grown at each station and all made satisfactory bread with good loaf volumes. The variety Conley produced the best bread in most respects by a slight margin at all three stations except for slightly lower crumb color and grain scores for the Moccasin sample. This minor factor was overbalanced by the larger loaf volume obtained for the variety at the same station. Selkirk was highest in flour yield and Lee best in test weight by a slight margin.

The Havre samples gave slightly lower loaf volumes and were below the expected loaf volumes, than were the samples from Moccasin and Sidney.

## Uniform Regional Nursery Composite

Twenty-four wheats from the uniform regional nursery have been tested in duplicate for their milling, baking, and chemical properties. These consisted of an eastern composite of grain from 8 stations and a western composite of grain from a like number of stations as shown in a footnote to table 2.

The results of the quality tests for the eastern and western composites and the averages of both are shown in table 2. The discussion of these samples will be based principally on the averages, except possibly for some reference for the purposes of comparison to the results obtained on the same varieties and strains grown at either the eastern or western composite stations.

Table 2.--Milling, baking, and chemical results on 24 wheats grown in the Uniform Regional Nursery for the Eastern Composite, Western Composite, and the average of the Eastern and Western composites in 1958.

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| **Eastern Composite 1/** | | | | | | | | | | | | | | | |
| Marquis | 3641 | 59.3 | 28 | 13.2 | 12.5 | 71.9 | .50 | 62 | 2.50 | 3.1 | 2 | 808 | 85 | 90 | 830 |
| Thatcher | 10003 | 59.6 | 27 | 13.6 | 13.2 | 74.7 | .51 | 62 | 2.50 | 3.5 | 2 | 840 | 85 | 95 | 865 |
| Selkirk | 13100 | 59.4 | 32 | 14.3 | 13.3 | 76.9 | .51 | 64 | 2.25 | 4.4 | 1 | 893 | 90 | 100 | 870 |
| Lee | 12488 | 59.7 | 30 | 15.1 | 14.3 | 73.8 | .52 | 62 | 2.50 | 3.4 | 1 | 850 | 85 | 95 | 920 |
| Reward x C.I. 12632 | 13406 | 61.1 | 30 | 14.3 | 13.4 | 76.0 | .56 | 62 | 2.25 | 4.0 | 1 | 850 | 85 | 90 | 875 |
| Ditto | 13407 | 61.0 | 31 | 14.6 | 13.7 | 75.0 | .56 | 61 | 2.25 | 4.4 | 1 | 820 | 80 | 95 | 890 |
| Conley | 13157 | 59.6 | 29 | 14.0 | 13.3 | 76.5 | .49 | 63 | 2.50 | 4.9 | 1 | 875 | 85 | 100 | 870 |
| K338AA x Ns. 3880.191 | 13301 | 62.0 | 28 | 14.8 | 13.7 | 75.7 | .48 | 63 | 2.50 | 4.2 | 2 | 855 | 90 | 100 | 890 |
| Ditto | 13302 | 62.2 | 29 | 15.1 | 14.0 | 74.9 | .55 | 64 | 2.25 | 4.3 | 2 | 945 | 90 | 90 | 905 |
| ND 4 x Ns. 3880.227 | 13317 | 61.4 | 34 | 14.4 | 13.4 | 77.3 | .48 | 65 | 2.25 | 4.7 | 2 | 975 | 85 | 100 | 875 |
| K338AA x Ns. 3880.191 | 13319 | 61.7 | 29 | 15.6 | 14.5 | 73.8 | .53 | 65 | 2.00 | 3.9 | 1 | 975 | 80 | 95 | 930 |
| Rushmore x K. Farmer | 13320 | 61.4 | 31 | 13.8 | 12.9 | 78.1 | .48 | 64 | 2.25 | 5.1 | 2 | 813 | 80 | 80 | 850 |
| Lee x ND 34 | 13322 | 60.2 | 30 | 14.6 | 13.4 | 75.5 | .48 | 63 | 2.25 | 4.1 | 2 | 898 | 90 | 95 | 875 |
| ND 4 x Lee | 13324 | 59.9 | 36 | 15.7 | 14.7 | 75.4 | .53 | 64 | 2.25 | 4.6 | 1 | 893 | 95 | 95 | 940 |
| Thatcher x K338AC | 13348 | 61.2 | 32 | 15.4 | 14.4 | 75.6 | .52 | 64 | 2.50 | 4.6 | 2 | 913 | 80 | 95 | 925 |
| ND 81 x Lee | 13349 | 60.1 | 31 | 14.8 | 13.9 | 75.6 | .54 | 65 | 2.50 | 4.5 | 2 | 953 | 85 | 100 | 900 |
| K338AA x N. 2350 | 13350 | 61.0 | 28 | 15.1 | 14.3 | 75.5 | .54 | 65 | 2.25 | 4.4 | 2 | 985 | 95 | 95 | 920 |
| Thatcher x R.L. 2564 | 13332 | 60.2 | 30 | 14.3 | 13.7 | 75.0 | .52 | 63 | 2.25 | 4.5 | 1 | 913 | 75 | 95 | 890 |
| That.$^{6}$ x K. Farmer | 13345 | 60.5 | 28 | 14.1 | 13.3 | 76.3 | .51 | 63 | 2.00 | 4.6 | 2 | 900 | 80 | 90 | 870 |
| Karnvor | 13347 | 58.8 | 30 | 12.4 | 11.8 | 75.2 | .48 | 61 | 1.75 | 4.6 | 1 | 868 | 70 | 90 | 795 |
| Overby | 13346 | 60.5 | 35 | 14.3 | 13.5 | 76.6 | .50 | 60 | 1.50 | 4.2 | 2 | 905 | 75 | 85 | 880 |
| II-44-11 x Lee$^{3}$ | 13404 | 60.8 | 29 | 14.8 | 13.7 | 75.3 | .52 | 66 | 2.75 | 4.7 | 1 | 865 | 85 | 95 | 890 |
| Thatcher x K. Farmer | 13403 | 59.8 | 35 | 14.8 | 13.7 | 75.5 | .50 | 61 | 2.25 | 5.0 | 2 | 913 | 85 | 95 | 890 |
| II-44-29 x Lee$^{3}$ | 13408 | 60.4 | 29 | 14.7 | 13.6 | 76.0 | .51 | 61 | 2.50 | 4.8 | 1 | 838 | 85 | 85 | 885 |

1/ Composite of seed from Brookings, Madison, Langdon, Fargo, Casselton, St. Paul, Crookston, and Morris.

Table 2.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling Index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| | | | | | | Western Composite 2/ | | | | | | | | | |
| Marquis | 3641 | 61.3 | 30 | 14.3 | 13.4 | 73.0 | .48 | 63 | 2.25 | 4.9 | 1 | 843 | 85 | 95 | 875 |
| Thatcher | 10003 | 60.8 | 29 | 14.6 | 13.9 | 74.3 | .48 | 62 | 1.75 | 4.7 | 1 | 925 | 80 | 95 | 900 |
| Selkirk | 13100 | 60.0 | 32 | 14.8 | 13.9 | 76.7 | .47 | 64 | 2.25 | 4.8 | 2 | 870 | 80 | 90 | 900 |
| Lee | 12488 | 61.0 | 31 | 15.5 | 14.4 | 73.0 | .44 | 64 | 2.25 | 4.6 | 2 | 915 | 90 | 95 | 925 |
| Reward x C.I. 12632 | 13406 | 61.5 | 30 | 15.0 | 13.8 | 72.8 | .46 | 63 | 2.25 | 4.9 | 1 | 880 | 85 | 95 | 895 |
| Ditto | 13407 | 61.5 | 31 | 14.9 | 14.0 | 74.5 | .47 | 65 | 2.50 | 4.9 | 2 | 805 | 80 | 90 | 905 |
| Conley | 13157 | 61.1 | 32 | 14.9 | 14.1 | 74.7 | .45 | 66 | 2.00 | 4.8 | 2 | 885 | 95 | 100 | 910 |
| K338AA x Ns. 3880.191 | 13301 | 62.3 | 28 | 14.5 | 13.8 | 75.3 | .46 | 64 | 2.00 | 4.6 | 2 | 850 | 75 | 95 | 895 |
| Ditto | 13302 | 62.5 | 29 | 15.1 | 14.4 | 73.2 | .50 | 64 | 2.25 | 4.6 | 2 | 865 | 80 | 95 | 925 |
| ND 4 x Ns. 3880.227 | 13317 | 61.0 | 34 | 15.2 | 14.1 | 75.5 | .49 | 65 | 2.00 | 4.9 | 2 | 875 | 85 | 95 | 910 |
| K338AA x Ns. 3880.191 | 13319 | 62.4 | 29 | 15.5 | 14.4 | 72.2 | .50 | 65 | 2.00 | 4.2 | 2 | 840 | 85 | 100 | 925 |
| Rushmore x K. Farmer | 13320 | 61.9 | 30 | 14.0 | 13.1 | 77.1 | .45 | 65 | 2.75 | 5.2 | 2 | 830 | 80 | 85 | 860 |
| Lee x ND 34 | 13322 | 61.3 | 31 | 14.3 | 13.4 | 73.4 | .45 | 65 | 2.00 | 4.9 | 2 | 855 | 85 | 95 | 875 |
| ND 4 x Lee | 13324 | 60.4 | 34 | 15.5 | 14.3 | 73.8 | .46 | 66 | 2.25 | 4.8 | 2 | 820 | 85 | 100 | 920 |
| Thatcher x K338AC | 13348 | 60.9 | 32 | 15.7 | 14.6 | 73.1 | .46 | 63 | 2.25 | 4.8 | 2 | 825 | 75 | 90 | 935 |
| ND 81 x Lee | 13349 | 60.8 | 31 | 15.3 | 14.4 | 74.1 | .50 | 65 | 2.25 | 4.7 | 2 | 825 | 75 | 95 | 925 |
| K338AA x N. 2350 | 13350 | 61.2 | 29 | 15.0 | 14.4 | 74.5 | .53 | 65 | 2.75 | 4.7 | 2 | 880 | 85 | 95 | 925 |
| Thatcher x R.L. 2564 | 13332 | 60.4 | 31 | 14.9 | 14.1 | 75.5 | .45 | 63 | 2.50 | 5.0 | 2 | 870 | 80 | 85 | 910 |
| That.$^{6}$ x K. Farmer | 13345 | 61.2 | 29 | 14.6 | 13.9 | 74.8 | .46 | 63 | 2.25 | 4.9 | 2 | 845 | 85 | 90 | 900 |
| Karnvor | 13347 | 60.4 | 31 | 13.8 | 13.1 | 74.2 | .42 | 59 | 2.25 | 5.2 | 2 | 840 | 75 | 80 | 860 |
| Overby | 13346 | 61.1 | 38 | 15.2 | 14.7 | 75.0 | .44 | 60 | 1.50 | 4.7 | 2 | 830 | 80 | 85 | 940 |
| II-44-11 x Lee$^{3}$ | 13404 | 60.9 | 28 | 15.4 | 14.3 | 73.4 | .48 | 62 | 3.00 | 4.8 | 2 | 850 | 85 | 95 | 920 |
| Thatcher x K. Farmer | 13403 | 60.5 | 33 | 14.5 | 14.0 | 74.5 | .45 | 63 | 2.00 | 4.8 | 2 | 940 | 80 | 100 | 905 |
| II-44-29 x Lee$^{3}$ | 13408 | 60.8 | 30 | 14.8 | 14.2 | 73.6 | .45 | 64 | 2.75 | 4.8 | 2 | 865 | 75 | 85 | 915 |

2/ Composite of seed from Sidney, Havre, Moccasin, Fort Collins, Laramie, Sheridan, Minot, and Alliance.

Table 2.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from Mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| Averages of the Eastern and Western Composites | | | | | | | | | | | | | | | | | |
| Marquis | 3641 | 60.3 | 29 | 13.8 | 13.0 | 72.5 | .49 | 63 | 2.38 | 4.0 | 2 | 826 | 85 | 93 | 853 | 2.50 | 1.75 |
| Thatcher | 10003 | 60.2 | 28 | 14.1 | 13.6 | 74.5 | .50 | 62 | 2.00 | 4.1 | 2 | 883 | 83 | 95 | 883 | 2.50 | 2.00 |
| Selkirk | 13100 | 59.7 | 32 | 14.6 | 13.6 | 76.8 | .49 | 64 | 2.25 | 4.6 | 2 | 882 | 85 | 95 | 885 | 2.50 | 1.25 |
| Lee | 12488 | 60.4 | 31 | 15.3 | 14.4 | 73.4 | .48 | 63 | 2.38 | 4.0 | 2 | 883 | 88 | 95 | 923 | 2.50 | 1.50 |
| Reward x C.I. 12632 | 13406 | 61.3 | 30 | 14.7 | 13.6 | 74.4 | .51 | 63 | 2.25 | 4.4 | 1 | 865 | 85 | 93 | 885 | 3.00 | 1.50 |
| Ditto | 13407 | 61.3 | 31 | 14.8 | 13.9 | 74.8 | .52 | 63 | 2.38 | 4.6 | 2 | 813 | 80 | 93 | 898 | 3.00 | 1.50 |
| Conley | 13157 | 60.4 | 31 | 14.5 | 13.7 | 75.6 | .47 | 65 | 2.25 | 4.8 | 2 | 880 | 90 | 100 | 890 | 2.75 | 1.50 |
| K338AA x Ns. 3880.191-1 | 13301 | 62.2 | 28 | 14.7 | 13.8 | 75.5 | .47 | 64 | 2.25 | 4.4 | 2 | 853 | 83 | 98 | 893 | 2.50 | 1.00 |
| Ditto | 13302 | 62.4 | 29 | 15.1 | 14.2 | 74.1 | .53 | 64 | 2.25 | 4.4 | 2 | 905 | 85 | 93 | 915 | 2.50 | 1.50 |
| ND 4 x Ns. 3880.227 | 13317 | 61.2 | 34 | 14.8 | 13.8 | 76.4 | .49 | 65 | 2.13 | 4.8 | 2 | 925 | 85 | 98 | 893 | 2.25 | 1.50 |
| K338AA x Ns. 3880.191 | 13319 | 62.1 | 29 | 15.6 | 14.5 | 73.0 | .52 | 65 | 2.00 | 4.0 | 2 | 908 | 83 | 98 | 928 | 2.00 | 1.00 |
| Rushmore x K. Farmer | 13320 | 61.7 | 31 | 13.9 | 13.0 | 77.6 | .47 | 65 | 2.50 | 5.2 | 2 | 822 | 80 | 83 | 855 | 3.00 | 2.00 |
| Lee x ND 34 | 13322 | 60.8 | 31 | 14.5 | 13.4 | 74.5 | .47 | 64 | 2.13 | 4.5 | 2 | 877 | 88 | 95 | 875 | 2.75 | 1.50 |
| ND 4 x Lee | 13324 | 60.2 | 35 | 15.6 | 14.5 | 74.6 | .50 | 65 | 2.25 | 4.7 | 2 | 857 | 90 | 98 | 930 | 2.25 | 1.75 |
| Thatcher x K338AC | 13348 | 61.1 | 32 | 15.6 | 14.5 | 74.4 | .49 | 64 | 2.38 | 4.7 | 2 | 869 | 78 | 93 | 930 | 2.75 | 1.75 |
| ND 81 x Lee | 13349 | 60.5 | 31 | 15.1 | 14.2 | 74.9 | .52 | 65 | 2.38 | 4.6 | 2 | 889 | 80 | 98 | 913 | 2.75 | 1.50 |
| K338AA x N. 2350 | 13350 | 61.1 | 29 | 15.1 | 14.4 | 75.0 | .54 | 65 | 2.50 | 4.6 | 2 | 933 | 90 | 95 | 923 | 3.00 | 2.00 |
| That. x R.L. 2564 | 13332 | 60.3 | 31 | 14.6 | 13.9 | 75.3 | .49 | 63 | 2.38 | 4.8 | 2 | 892 | 78 | 90 | 900 | 3.25 | 2.00 |
| That.[6] x K.Farmer | 13345 | 60.9 | 29 | 14.4 | 13.6 | 75.6 | .49 | 63 | 2.13 | 4.8 | 2 | 873 | 83 | 90 | 885 | 3.00 | 1.25 |
| Karnvor | 13347 | 59.6 | 31 | 13.1 | 12.5 | 75.7 | .45 | 60 | 2.00 | 4.9 | 2 | 854 | 73 | 85 | 828 | 2.75 | 1.75 |
| Overby | 13346 | 60.8 | 37 | 14.8 | 14.1 | 75.8 | .47 | 60 | 1.50 | 4.4 | 2 | 868 | 78 | 85 | 910 | 1.75 | .75 |
| II-44-11 x Lee[3] | 13404 | 60.9 | 29 | 15.1 | 14.0 | 74.4 | .50 | 64 | 2.78 | 4.8 | 2 | 858 | 85 | 95 | 905 | 3.50 | 2.25 |
| That. x K. Farmer | 13403 | 60.2 | 34 | 14.7 | 13.9 | 75.0 | .48 | 62 | 2.13 | 4.9 | 2 | 927 | 83 | 98 | 898 | 2.50 | 1.00 |
| II-44-29 x Lee[3] | 13408 | 60.6 | 30 | 14.8 | 13.9 | 74.8 | .48 | 63 | 2.63 | 4.8 | 2 | 852 | 80 | 85 | 900 | 3.50 | 2.00 |

Most of the samples from the uniform regional nurseries made reasonably good bread, with only a slight difference in quality between many of the varieties and strains.

In some years the properties or characteristics of the same variety or strain grown at the eastern or western composite stations are somewhat different, due, no doubt, to a difference in environmental conditions. The western composites were slightly higher in test weight than the eastern samples. The samples from both sections were slightly better in test weights this year than those of last year's composites. The pearling index values obtained were also slightly higher on this year's samples. There were some variations, for the most part, between the varieties and strains with samples from the western stations equal to or slightly higher in pearling index values than those from the east. The medium-low pearling index values indicated that most of the 1958 strains were similar to the approved hard red spring varieties in hardness. The only exceptions were strains ND 4 x Lee (C.I. 13324), ND 4 x Ns. 3880.227 (C.I. 13317), Thatcher x Kenya Farmer (C.I. 13403), and Overby, which had higher pearling index values than Marquis or Thatcher, indicating softer texture. These softer wheats may not meet with approval of the milling trade because of problems in tempering and milling when used in blends with the harder textured approved spring wheat varieties.

The wheats milled satisfactorily and produced a relatively high yield of low to medium ash flour. The only exception was strain K338AA x N2350 (C.I. 13350) which had the highest flour ash content of the nursery samples. This may possibly be an inherent property of this strain. The wheats having the highest flour yields were Selkirk, Rushmore x K. Farmer (C.I. 13320), and ND 4 x Ns. 3880.227 (C.I. 13317). C.I. Nos. 13320 and 13317 had excellent milling properties and were superior to the other nursery samples in this respect. Wheat and flour proteins were slightly lower, on the average, than the protein contents for the same varieties or strains tested last year. The wheat proteins of the western composites ranged up to 1.4 percent higher than those of the same varieties or strains in the eastern composites, with the exception of Thatcher x K. Farmer (C.I. 13403) which had a wheat protein content that was only slightly higher in the eastern composite. The highest average wheat protein contents ranged from 15.1 to 15.6 percent for Lee, K338AA x Ns. 3880.191 (C.I. Nos. 13302 and 13319), ND 4 x Lee (C.I. 13324), Thatcher x K338AC (C.I. 13348), ND 81 x Lee (C.I. 13349), K338AA x N2350 (C.I. 13350) and II-44-11 x Lee$^3$ (C.I. 13404). Karnvor was lowest (13.1 percent) of the samples in wheat protein content. The water absorptions were very similar for the eastern and western composite samples, varying from 60 to 65 percent.

The small differences in quality between a number of the strains have made it extremely difficult to rank the wheats. Most strains produced bread that was satisfactory in grain with some better than others. Many strains had good quality and the desirable characteristics looked for in a wheat intended for bread. It is of interest that 16 of the 24 varieties and strains in the eastern composite and 15 of the wheats in the western

composite produced bread scoring 95 or above in crumb grain. This excellent showing in one of the important bread properties should be encouraging proof that satisfactory parent material is being used in the hard red spring breeding program. The crumb color scores were good with the greatest percentage of the samples making bread having crumb color scores of 85 or higher.

The approved hard red spring varieties Marquis, Thatcher, Selkirk, Lee, and Conley made satisfactory bread. Thatcher and Conley were the strongest wheats of this group and showed good dough strength.

Mixogram patterns or curves have been made on the flour composited by variety and strain from the 24 eastern and western samples. The results of these tests show that there were some differences in the dough characteristics between a number of the samples. The mixogram patterns for Marquis, Conley, Thatcher, and Lee were quite typical of acceptable bread wheats and evidenced satisfactory mixing properties. Selkirk had a reasonably long dough development time but it was shortest of the approved varieties in mixing tolerance. Mixing tolerances for the same varieties or strains were shorter this year than those obtained in the 1957 tests. This was due, in part, possibly to the lower protein content of this year's samples. Overby showed again its undesirable weak dough characteristics.

There were a number of strains in addition to the named varieties that showed good dough quality; e.g., development time and mixing tolerance according to the mixogram tests. These are as follows: Rushmore x Kenya Farmer (C.I. 13320), K338AA x N2350 (C.I. 13350), Thatcher x $R_3$L. 2564 (C.I. 13332), II-44-11 x Lee$^3$ (C.I. 13404), and II-44-29 x Lee$^3$ (C.I. 13408). Strains C.I. Nos. 13408, 13350, and 13320 were slightly down on one or more of their quality properties, which have been mentioned elsewhere in this discussion.

Those strains perhaps strongest in general quality and making the best bread, considering the data as a whole, were: Reward x C.I. 12632 (C.I. Nos. 13406 and 13407), K338AA x Ns. 3880.191 (C.I. 13302), Lee x ND 34 (C.I. 13322), Thatcher x K338AC (C.I. 13348), ND 81 x Lee (C.I. 13349), Thatcher x R.L. 2564 (C.I. 13332), and II-44-11 x Lee$^3$ (C.I. 13404). The quality of the dough according to the mixogram tests and the handling properties at the time of panning were generally satisfactory for these samples. A number of the other strains would have rated higher in quality had one or more of their quality properties been better. These strains and their lower quality properties are as follows: Thatcher$^6$ x Kenya Farmer (C.I. 13345) and K338AA x Ns. 3880.191 (C.I. Nos. 13301 and 13319), short dough mixing tolerance; ND 4 x Ns. 3880.227 (C.I. 13317) and ND 4 x Lee (C.I. 13324), high pearling index values indicative of soft texture; K338AA x N2350 (C.I. 13350), high flour ash content; Thatcher x Kenya Farmer (C.I. 13403), short dough mixing tolerance and high pearling index value; and Rushmore x Kenya Farmer (C.I. 13320) and II-44-29 x Lee$^3$ (C.I. 13408), poor grain of bread crumb. The varieties Karnvor and Overby were deficient in dough handling properties, being soft, weak and sticky. The dough development time and mixing tolerance for Overby according to the mixogram tests were shortest of the 24 nursery samples.

## State Nursery Trials

Results for the samples grown in the State nursery trials are shown in table 3. These include samples from Madison, Wisconsin, and composites of a number of varieties and strains grown in the Sawfly nursery at Moccasin and Sidney, Montana, and from the Advanced Yield nursery at Huntley and Moccasin, Montana.

### Madison, Wisconsin

The varieties and strains have made generally satisfactory bread, when considered in relation to the protein content of the wheats. All samples produced bread with good grain characteristics. The flour yields were exceptionally high when considered in relation to the test weight per bushel of the wheats.

The best bread, considering the data as a whole, from the nursery strains was made from Wis. 250 (C.I. 13098), H515B-7-2-12-17-1-2, H515B-7-2-12-17-4-2, Y-TK x Wis. $250^3$ Sel. 1-2-5, and Kenya 184 x Wis. $250^4$ Sel. 6-12. These wheats milled satisfactorily and produced a reasonably high yield of flour of acceptable ash content. The dough-handling characteristics were strong and elastic and the dough-mixing time moderately long and similar to the approved hard red spring varieties. The bread produced from the flour was high in loaf volume and the grain of the crumb excellent. Strain H500-6-1-4-2 was equally as good in most quality characteristics as the wheats already mentioned, except possibly for the ash content of the flour which was higher than normal. One of the most promising properties of all these strains was the excellent grain of the bread and the high flour yield of the wheats.

Those wheats that were next best in quality were Kenya 184 P.2 A.I.F., H515B-7-2-12-5 and No. 58 x Wis. $250^3$ x Sel. 1-1-1. These strains were only slightly lower in grain of bread than the strains already discussed. Two of these strains produced an excellent yield of flour, were low in ash content, and their dough-handling properties and mixing time were satisfactory.

The two strains C.I. 12633 x Henry$^2$ Sel. 1-1 and Sel. 1-3-4, milled satisfactorily, produced an excellent yield of flour of low ash content, made bread of very good loaf volume and internal characteristics, but had shorter dough-mixing times than the approved hard red spring varieties. These two selections are perhaps slightly stronger in quality than the comparably grown Henry, which also had a short dough-mixing time.

The variety Henry, similar to last year's tests, was lowest in wheat protein content. It was lowest in loaf volume of the nursery samples grown at Madison, Wisconsin.

Table 3.--Milling, baking, and chemical results on hard red spring wheats grown in State nursery trials, 1958 crop.

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| Rod Row Yield Nursery - Madison, Wisconsin | | | | | | | | | | | | | | | |
| Lee | 12488 | 60.3 | 29 | 14.0 | 12.9 | 76.3 | .52 | 63 | 2.50 | 4.3 | 2 | 810 | 85 | 85 | 850 |
| Wis. 250 | 13098 | 59.9 | 31 | 14.1 | 12.7 | 76.8 | .49 | 59 | 2.25 | 4.1 | 2 | 873 | 80 | 95 | 840 |
| Kenya 184 P.2.A.I.F. | | 60.9 | 34 | 13.6 | 12.5 | 75.1 | .50 | 59 | 2.25 | 5.0 | 2 | 828 | 75 | 90 | 830 |
| H500-6-1-4-2 | | 61.1 | 32 | 13.8 | 12.8 | 77.9 | .56 | 59 | 2.25 | 4.8 | 2 | 823 | 80 | 95 | 845 |
| C.I. 12633 x Henry[2], Sel. 1-1 | | 61.2 | 35 | 14.1 | 12.9 | 78.2 | .52 | 59 | 1.75 | 4.9 | 2 | 843 | 80 | 95 | 850 |
| C.I. 12633 x Henry[2], Sel. 1-3-4 | | 61.1 | 35 | 14.0 | 12.7 | 77.3 | .51 | 61 | 1.75 | 4.6 | 2 | 875 | 80 | 95 | 840 |
| Henry | 12265 | 60.7 | 33 | 12.3 | 11.3 | 79.4 | .50 | 59 | 1.75 | 4.0 | 2 | 790 | 75 | 90 | 770 |
| H515B-7-2-12-5 | | 59.2 | 30 | 13.8 | 12.4 | 76.4 | .50 | 59 | 2.25 | 4.1 | 2 | 880 | 90 | 90 | 825 |
| H515B-7-2-12-17-1-2 | | 58.9 | 30 | 14.0 | 12.9 | 75.6 | .48 | 60 | 2.25 | 4.3 | 1 | 923 | 85 | 95 | 850 |
| H515B-7-2-12-17-4-2 | | 59.3 | 31 | 14.2 | 13.2 | 76.4 | .50 | 60 | 2.50 | 4.0 | 1 | 920 | 75 | 95 | 865 |
| Y-TK x Wis. 250[3] Sel. 1-2-5 | | 59.6 | 31 | 13.5 | 12.6 | 77.4 | .49 | 62 | 2.00 | 3.4 | 2 | 895 | 80 | 95 | 835 |
| No. 58 x Wis. 250[3] Sel. 1-1-1 | | 60.8 | 30 | 13.9 | 12.8 | 77.8 | .49 | 60 | 2.00 | 3.9 | 2 | 843 | 80 | 90 | 845 |
| Kenya 184 x Wis. 250[4] Sel. 6-12 | | 60.9 | 32 | 15.0 | 14.2 | 76.9 | .53 | 62 | 3.00 | 4.4 | 2 | 955 | 80 | 95 | 915 |

Table 3.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| **Montana Advanced Yield Nursery 1/** | | | | | | | | | | | | | | | |
| Selkirk | 13100 | 58.8 | 30 | 15.4 | 14.5 | 76.4 | .50 | 63 | 2.00 | 4.5 | 2 | 865 | 80 | 95 | 930 |
| Ceres | 6900 | 60.7 | 26 | 15.8 | 15.1 | 75.4 | .51 | 66 | 2.75 | 4.2 | 2 | 888 | 80 | 90 | 960 |
| Thatcher x Lee | | 59.6 | 28 | 16.4 | 15.2 | 74.4 | .54 | 65 | 2.00 | 4.1 | 1 | 903 | 80 | 90 | 965 |
| 1898 x Lee | | 60.6 | 28 | 16.6 | 15.3 | 76.0 | .54 | 66 | 2.50 | 4.2 | 1 | 968 | 85 | 95 | 970 |
| That.$^{6}$ x K. Farmer | 13345 | 60.1 | 28 | 16.0 | 15.6 | 75.0 | .54 | 67 | 2.00 | 4.1 | 1 | 953 | 80 | 90 | 985 |
| Rescue x 1831 | 13304 | 61.2 | 29 | 15.6 | 15.1 | 75.4 | .55 | 66 | 2.00 | 4.2 | 1 | 960 | 70 | 80 | 960 |
| Lee | 12488 | 60.2 | 31 | 16.5 | 15.7 | 76.6 | .56 | 66 | 2.25 | 4.2 | 1 | 968 | 80 | 90 | 990 |
| Centana | 12974 | 59.9 | 28 | 16.2 | 15.4 | 74.9 | .49 | 64 | 2.00 | 4.7 | 1 | 933 | 80 | 90 | 975 |
| Thatcher | 10003 | 60.1 | 29 | 16.2 | 15.6 | 75.3 | .54 | 65 | 2.00 | 4.3 | 1 | 925 | 75 | 95 | 985 |
| Lake | 13413 | 57.7 | 30 | 16.6 | 16.0 | 73.6 | .47 | 65 | 1.75 | 4.4 | 2 | 990 | 90 | 95 | 1005 |
| 1953 x Lee | 13242 | 60.0 | 30 | 15.2 | 14.3 | 72.9 | .39 | 63 | 2.00 | 4.8 | 2 | 835 | 85 | 95 | 920 |
| Lee$^{6}$ x K. Farmer | 13221 | 59.0 | 32 | 16.2 | 15.8 | 73.0 | .51 | 66 | 2.25 | 4.1 | 2 | 865 | 75 | 95 | 995 |
| Chinook | 13220 | 61.6 | 32 | 15.9 | 15.4 | 73.6 | .48 | 62 | 2.25 | 4.2 | 1 | 853 | 80 | 90 | 975 |
| Rescue | 12435 | 59.5 | 32 | 15.9 | 15.2 | 73.6 | .44 | 59 | 2.25 | 4.5 | 2 | 895 | 75 | 95 | 965 |
| Conley | 13157 | 57.6 | 31 | 16.2 | 15.6 | 73.2 | .44 | 65 | 2.25 | 4.4 | 2 | 930 | 90 | 100 | 985 |
| Pilot | 11945 | 58.4 | 27 | 16.0 | 14.7 | 72.1 | .43 | 65 | 2.50 | 4.8 | 1 | 938 | 80 | 95 | 940 |
| Overby | 13346 | 60.4 | 35 | 16.3 | 15.5 | 74.2 | .47 | 61 | 1.75 | 4.6 | 2 | 915 | 70 | 90 | 980 |
| 1953 x Lee | | 59.5 | 32 | 15.5 | 15.0 | 74.3 | .48 | 63 | 1.75 | 4.3 | 1 | 930 | 80 | 95 | 955 |
| Thatcher x Lee | | 59.7 | 34 | 15.9 | 15.3 | 73.3 | .48 | 62 | 2.00 | 4.5 | 1 | 985 | 85 | 95 | 970 |

1/ Composite of seed from Huntley and Moccasin.

Table 3.--(Continued)

| Variety or Cross | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| Montana International Sawfly Yield Nursery 2/ | | | | | | | | | | | | | | | |
| Rescue x Chinook | 13309 | 61.2 | 29 | 15.2 | 14.5 | 78.2 | .44 | 62 | 2.25 | 4.6 | 2 | 903 | 75 | 85 | 930 |
| Ditto | 13310 | 61.6 | 33 | 16.3 | 15.5 | 73.7 | .45 | 62 | 2.25 | 4.5 | 1 | 923 | 75 | 90 | 980 |
| " | 13344 | 61.8 | 31 | 15.0 | 14.7 | 75.5 | .42 | 63 | 2.25 | 4.6 | 1 | 888 | 75 | 85 | 940 |
| " | 13329 | 61.3 | 34 | 15.2 | 14.6 | 76.8 | .42 | 63 | 2.25 | 4.6 | 1 | 890 | 85 | 95 | 935 |
| That.4 x Rescue | 13412 | 60.8 | 27 | 15.1 | 14.1 | 73.0 | .42 | 61 | 2.25 | 4.5 | 1 | 890 | 85 | 95 | 910 |
| Rescue x Chinook | 13308 | 60.9 | 32 | 15.3 | 14.3 | 76.8 | .43 | 64 | 2.00 | 4.9 | 1 | 950 | 70 | 95 | 920 |
| That.2 x Rescue | 13411 | 60.7 | 27 | 15.1 | 13.8 | 74.5 | .42 | 63 | 2.00 | 4.0 | 1 | 830 | 80 | 90 | 895 |
| Rescue x Thatcher | 13307 | 62.0 | 33 | 16.1 | 15.1 | 76.7 | .41 | 61 | 2.00 | 4.6 | 1 | 933 | 80 | 100 | 960 |
| Thatcher | 10003 | 60.3 | 28 | 15.8 | 14.7 | 74.4 | .42 | 64 | 2.00 | 4.4 | 1 | 938 | 80 | 95 | 940 |
| Chinook | 13220 | 61.5 | 29 | 15.5 | 14.6 | 73.6 | .41 | 64 | 2.00 | 4.0 | 2 | 843 | 80 | 95 | 935 |
| Rescue x Cadet | 13328 | 60.9 | 27 | 15.6 | 14.8 | 74.1 | .44 | 64 | 2.25 | 4.6 | 2 | 930 | 75 | 100 | 945 |
| Rescue-N1315 x G.B. | 13409 | 59.9 | 32 | 15.8 | 14.8 | 75.2 | .45 | 62 | 2.75 | 4.6 | 1 | 930 | 70 | 95 | 945 |
| Rescue x Chinook | 13330 | 61.2 | 34 | 15.8 | 15.2 | 73.8 | .40 | 63 | 2.50 | 4.7 | 2 | 963 | 75 | 95 | 965 |
| Rescue-N1315 x G.B. | 13410 | 60.6 | 30 | 15.3 | 14.3 | 73.6 | .46 | 64 | 2.25 | 4.8 | 1 | 1015 | 75 | 100 | 920 |
| Rescue | 12435 | 60.4 | 32 | 15.6 | 14.9 | 74.9 | .45 | 63 | 2.00 | 4.6 | 1 | 965 | 75 | 90 | 950 |
| Rescue x 1831 | 13304 | 61.2 | 30 | 14.6 | 14.3 | 77.3 | .44 | 64 | 2.25 | 4.5 | 1 | 905 | 80 | 90 | 920 |

2/ Composite of seed from Moccasin and Sidney, Montana.

## Advanced Yield Nursery

### Huntley and Moccasin, Montana

The small differences in quality between a number of the samples have made it extremely difficult to rank the wheats. Most all produced bread satisfactory in grain, with some better than others. It is of interest that 11 of the 19 samples produced bread scoring 95 or above in crumb grain. This is an excellent showing for one of the important bread properties. The crumb color scores were low to medium with only 2 of the 19 samples scoring as high as 90 in color.

All the samples milled satisfactorily. A number of the wheats produced a high yield of flour averaging 75.0 percent or better.

There was little variation between the samples in the test weight per bushel, flour yield and wheat and flour protein contents. All the wheats were relatively high in protein content with none lower than 14.3 percent in the flour. This accounts, no doubt, in part for the good quality of many of these wheats for bread-making.

The approved hard red spring varieties, Selkirk, Ceres, Lee, Thatcher, Conley, Pilot, Centana, and Rescue made satisfactory bread. Thatcher and Conley were perhaps strongest of these varieties in dough-handling properties. There were a number of other named varieties that would have been better for bread, had they not been deficient in one or more quality properties. These varieties and their deficient quality properties are as follows: Chinook, because of its much lower loaf volume than expected for the protein content of the flour; Lake, for its shorter dough-mixing time as compared with that of Lee and Thatcher; and Overby, because of its mellow, weak dough properties, low crumb color and short dough-mixing time.

The strains that appear to be best in quality, considering the data as a whole were 1898 x Lee (B52-57), Thatcher$^{6}$ x Kenya Farmer (C.I. 13345) and Thatcher x Lee (B55-21). Next best and nearly as good as the above named wheats were Rescue x 1831 (C.I. 13304) and Thatcher x Lee (B55-5). All the above wheats had good handling properties, and the bread was satisfactory in volume and grain. Rescue x 1831 was lowest of the group in crumb color but this is perhaps not too important since it is common practice to bleach flour.

A number of the other strains would be more promising for bread if not deficient in one or more of their quality properties. These strains and their lower quality property or properties are as follows: 1953 x Lee (C.I. 13242) slightly low flour yield and lower loaf volume as compared to that expected according to the protein content; Lee$^{6}$ x Kenya Farmer lower than expected loaf volume (this strain has a low specific sedimentation value) and 1953 x Lee (B52-94) shorter dough-mixing time than the comparably grown Lee or Conley.

It is of interest to note that strain 1953 x Lee (C.I. 13242), although deficient in some properties, was one of the samples lowest in flour ash content.

## International Sawfly Yield Nursery

Moccasin and Sidney, Montana

The results for a number of varieties and strains resistant to wheat stem sawfly grown in the International Sawfly Yield Nursery trials at Moccasin and Sidney, Montana are shown in table 3. These trials include many strains of current interest. One of the principal interests in these tests is a comparison of the quality of the strains which include Rescue in their parentage, with that of Thatcher and Rescue.

These samples made generally acceptable bread with good grain and loaf volume. However, a tendency for yellowness in the crumb color for most of the samples was somewhat undesirable. The two samples in the group having the best crumb color by a small degree were strains Rescue x Chinook (C.I. 13329) and Thatcher[4] x Rescue (C.I. 13412). The small differences in quality between most of the samples made it difficult to rank the wheats. All the wheats were relatively high in protein and possessed most of the quality characteristics found in approved varieties. Due to this fact most of the discussion will be based on a consideration of the quality data as a whole with minor differences pointed out. The test weights, flour yields, water absorption, and loaf volumes were relatively high with desirably low ash contents and pearling index values. Mixing times of 2.00 to 2.75 minutes and bromate response were average.

Thatcher[2] x Rescue (C.I. 13411) had a flour protein slightly below that expected from a wheat with 15.1 protein. This factor seems to carry through to the somewhat lower specific sedimentation value and loaf volume. Chinook also had a slightly lower specific sedimentation value and loaf volume which would tend to indicate the possibility of a slightly poorer quality gluten.

Three of the samples had higher loaf volumes than the expected when considering their respective flour protein contents. These were Rescue x Chinook (C.I. 13308), Rescue - N1315 x G.B. (C.I. 13410), and Rescue (C.I. 12435) indicating possibly an inherent quality of the parent variety, Rescue. Strain C.I. 13410 was best of these with nearly a 100 cc increase in loaf volume over the expected volume.

All the wheats milled satisfactorily and the flours produced doughs with strong to very strong or bucky handling properties with only Rescue x Cadet (C.I. 13328) having only moderate strength and a slight softness when panned. Seven of the 16 varieties and strains had excellent milling properties. The promising milling wheats are Rescue x Chinook (C.I. Nos. 13309, 13344, 13329, and 13308), Rescue x Thatcher (C.I. 13307), Thatcher, and Rescue x 1831 (C.I. 13304).

Those wheats perhaps strongest in quality and making the best bread considering the data as a whole, were Rescue, Rescue x Chinook (C.I. Nos. 13309 and 13329), Rescue x Chinook (C.I. 13308), Thatcher[2] x Rescue (C.I. 13411), Rescue x Thatcher (C.I. 13307), Thatcher, Rescue x Cadet (C.I. 13328), Rescue x N1315 x G.B. (C.I. 13410) and Rescue x 1831 (C.I. 13304). The dough handling characteristics of these samples were strong and elastic. A number of the strains produced bread having excellent (scoring 100) grain.

Chinook was not as strong as the other samples. It was high in protein content, had a low specific sedimentation value and produced a loaf volume somewhat lower than expected for the protein content of the flour.

## Commercial Samples

As in past years, a number of commercially-grown wheat samples were obtained through the Grain Division, Agricultural Marketing Service, for comparison with the varieties and strains produced in experimental plots. Twenty-five such samples representing a number of grades and subclasses were obtained at Great Falls, Montana; Denver, Colorado; and Minneapolis and Duluth, Minnesota. The samples were composited by grade from 3,357 cars of wheat grading No. 4 or better. This is the twentieth season such samples have been tested. The results are given in table 4.

These samples generally averaged lower in protein content than the varieties and strains grown in experimental plot and nursery trials. The Minneapolis and Duluth, Minnesota samples averaged 13.5 and 13.4 respectively; the Great Falls, Montana and Denver, Colorado samples were somewhat higher, averaging 14.3 and 14.6 percent, respectively. The milling characteristics were much alike for the commercial and experimental samples, with the commercial samples possibly slightly higher in yield of flour on the average. Otherwise, the baking and chemical results do not appear to be greatly different when compared with samples having approximately the same protein content.

## Notes on Some of the New Strains of Current Interest

Each year many new strains of wheat are tested along with the approved hard red spring varieties for chemical composition, milling, and bread-baking quality. The data on three strains of current interest with averages of comparable samples of a number of approved hard red spring varieties are shown in table 5.

### Thatcher$^6$ x Kenya Farmer (C.I. 13345)

Comparable milling and baking tests of 9 samples of Thatcher$^6$ x Kenya Farmer (C.I. 13345) show that on the average it is quite comparable to Thatcher in most of the quality characteristics for which comparisons have been made. It is similar to Lee in test weight, flour yield, ash content of flour, water absorption, bromate response, specific sedimentation value, and crumb grain. Lee has averaged slightly higher in pearling index value, wheat and flour protein content, mixing time and loaf volume than Thatcher$^6$ x Kenya Farmer. The crumb color for Thatcher$^6$ x Kenya Farmer was slightly lower than that obtained for Lee, Selkirk, and Conley. The dough mixing time and tolerance, according to the mixograph tests, varied somewhat among the samples ranging from moderately long to very long. Averages show that Thatcher$^6$ x Kenya Farmer was perhaps not as strong as Thatcher in mixing time and tolerance. It had about the same mixing time and a moderately longer mixing tolerance than Conley, Selkirk, and Lee. This strain has many of the favorable properties found in approved hard red spring varieties.

Table 4.--Milling, baking, and chemical results on 25 composite commercial samples from 3,357 cars of hard red spring wheat obtained at Denver, Duluth, Great Falls, and Minneapolis, representing the 1958 crop.

| Location where obtained | U. S. grade | No. of cars | Test weight | Pearling index value | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | | Development time | Mixing tolerance |
| | | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| Denver, Colo. | 1HDNS | 24 | 60.7 | 31 | 13.9 | 13.6 | 75.3 | .42 | 65 | 2.00 | 3.8 | 2 | 890 | 85 | 90 | 885 | 2.50 | 1.50 |
| Do. | 1DNS | 22 | 59.4 | 29 | 14.8 | 14.0 | 75.4 | .44 | 64 | 2.00 | 4.6 | 2 | 925 | 80 | 90 | 905 | 2.50 | 1.25 |
| Do. | 2DNS | 11 | 57.5 | 28 | 14.8 | 14.1 | 74.5 | .46 | 64 | 2.00 | 4.6 | 1 | 860 | 75 | 90 | 910 | 2.50 | 1.50 |
| Do. | 3DNS | 16 | 56.4 | 29 | 14.7 | 14.1 | 74.1 | .47 | 66 | 2.00 | 4.7 | 2 | 875 | 75 | 90 | 910 | 2.75 | 1.50 |
| Average | | | 58.5 | 29 | 14.6 | 14.0 | 74.8 | .45 | 65 | 2.00 | 4.4 | 2 | 888 | 79 | 90 | 902 | 2.56 | 1.44 |
| Duluth, Minn. | 1HDNS | 546 | 61.3 | 30 | 13.9 | 13.0 | 75.9 | .46 | 66 | 2.50 | 4.3 | 2 | 825 | 70 | 75 | 855 | 2.75 | 1.50 |
| Do. | 1HNS | 34 | 61.5 | 30 | 11.7 | 10.8 | 76.7 | .48 | 65 | 2.75 | 3.8 | 2 | 770 | 70 | 85 | 745 | 3.50 | 3.00 |
| Do. | 1DNS | 197 | 59.4 | 32 | 14.5 | 13.3 | 75.9 | .47 | 64 | 2.50 | 4.7 | 2 | 860 | 80 | 90 | 870 | 2.75 | 1.50 |
| Do. | 2DNS | 485 | 60.5 | 30 | 13.8 | 13.1 | 75.6 | .46 | 66 | 2.75 | 4.6 | 1 | 845 | 80 | 95 | 860 | 3.00 | 1.50 |
| Do. | 3DNS | 115 | 60.0 | 31 | 13.9 | 12.8 | 75.5 | .47 | 66 | 2.50 | 4.8 | 2 | 860 | 70 | 80 | 845 | 3.00 | 1.50 |
| Do. | 3DNS | 44 | 59.0 | 32 | 14.1 | 13.0 | 75.3 | .47 | 65 | 2.50 | 4.7 | 2 | 855 | 80 | 90 | 855 | 3.25 | 1.75 |
| Do. | 1NS | 65 | 59.0 | 34 | 12.9 | 12.0 | 76.4 | .47 | 63 | 2.25 | 4.0 | 2 | 790 | 75 | 90 | 805 | 3.50 | 1.75 |
| Do. | 2NS | 76 | 59.3 | 32 | 12.4 | 11.7 | 76.4 | .46 | 64 | 2.50 | 3.9 | 2 | 775 | 75 | 100 | 790 | 3.75 | 2.75 |
| Do. | 2NS | 35 | 57.5 | 33 | 13.0 | 11.9 | 76.0 | .47 | 62 | 2.75 | 4.1 | 2 | 830 | 70 | 95 | 800 | 3.75 | 2.00 |
| Do. | 4NS | 20 | 57.3 | 33 | 13.7 | 12.5 | 75.0 | .48 | 64 | 2.50 | 4.7 | 2 | 860 | 75 | 90 | 830 | 3.75 | 2.50 |
| Average | | | 59.5 | 32 | 13.4 | 12.4 | 75.9 | .47 | 64 | 2.55 | 4.4 | 2 | 827 | 74 | 89 | 825 | 3.30 | 1.98 |

Table 4.--(Continued)

| Location where obtained | U. S. grade | No. of cars | Test weight | Pearling index value | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume | Quality of dough from mixogram tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb | | | Development time | Mixing tolerance |
| | | | | | | | | | | | | | | Color | Grain | | | |
| | | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. | Min. | Min. |
| Great Falls, Mont. | 1HDNS | 530 | 61.1 | 31 | 14.1 | 13.1 | 74.3 | .45 | 63 | 2.50 | 5.0 | 2 | 813 | 70 | 90 | 860 | 3.00 | 2.00 |
| Do. | 1DNS | 162 | 59.4 | 33 | 15.4 | 14.5 | 74.5 | .47 | 64 | 2.50 | 4.7 | 2 | 905 | 75 | 90 | 930 | 3.25 | 1.75 |
| Do. | 2DNS | 34 | 60.7 | 32 | 14.0 | 13.1 | 73.5 | .47 | 63 | 2.25 | 4.9 | 1 | 830 | 75 | 90 | 860 | 3.25 | 2.00 |
| Do. | 3DNS | 37 | 61.4 | 30 | 13.7 | 12.7 | 72.8 | .47 | 62 | 2.50 | 5.0 | 1 | 800 | 75 | 85 | 840 | 2.75 | 1.75 |
| Average | | | 60.6 | 32 | 14.3 | 13.4 | 73.8 | .46 | 63 | 2.44 | 4.9 | 2 | 838 | 74 | 89 | 872 | 3.06 | 1.88 |
| Minneapolis, Minnesota | 1HDNS | 331 | 61.4 | 32 | 13.4 | 12.6 | 75.3 | .47 | 62 | 2.50 | 4.4 | 2 | 815 | 75 | 95 | 835 | 3.25 | 2.00 |
| Do. | 1DNS | 137 | 59.2 | 32 | 14.6 | 13.4 | 75.1 | .48 | 65 | 2.75 | 4.8 | 2 | 895 | 75 | 95 | 875 | 3.50 | 1.75 |
| Do. | 2DNS | 285 | 61.0 | 32 | 13.5 | 12.6 | 74.6 | .49 | 62 | 2.50 | 4.2 | 2 | 830 | 80 | 95 | 835 | 3.25 | 2.25 |
| Do. | 3DNS | 46 | 56.7 | 32 | 14.3 | 13.2 | 74.1 | .49 | 61 | 2.75 | 4.6 | 2 | 778 | 85 | 90 | 865 | 4.25 | 2.00 |
| Do. | 4DNS | 16 | 54.3 | 31 | 13.1 | 12.3 | 74.6 | .50 | 59 | 2.75 | 4.6 | 2 | 745 | 80 | 90 | 820 | 5.00 | 4.25 |
| Do. | 1NS | 33 | 59.0 | 35 | 12.9 | 12.1 | 76.2 | .48 | 61 | 2.75 | 3.9 | 2 | 755 | 80 | 90 | 810 | 3.50 | 3.00 |
| Do. | 2NS | 56 | 59.8 | 33 | 12.7 | 11.9 | 75.3 | .52 | 62 | 2.75 | 3.4 | 2 | 733 | 80 | 90 | 800 | 3.50 | 2.50 |
| Average | | | 58.8 | 32 | 13.5 | 12.6 | 75.0 | .49 | 62 | 2.68 | 4.3 | 2 | 793 | 79 | 92 | 834 | 3.75 | 2.54 |

Table 5.--Average quality characteristics of a number of strains of current interest compared with approved hard red spring wheats.

| Variety or Cross | No. of samples | C.I. No. | Test weight | Pearling index | Protein | | Flour | | Absorption | Mixing time | Spec. sedimentation | Optimum baking method | | | | Expected loaf volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Wheat | Flour | Yield | Ash | | | | Bromate | Loaf volume | Crumb Color | Crumb Grain | |
| | | | Lbs. | Pct. | Pct. | Pct. | Pct. | Pct. | Pct. | Min. | Ml. | Mg. | Cc. | Score | Score | Cc. |
| Thatcher[6] x Ken. Farm. | 9 | 13345 | 60.5 | 27 | 13.8 | 12.4 | 71.8 | .48 | 62 | 2.17 | 4.4 | 1 | 823 | 77 | 88 | 853 |
| Thatcher | 9 | 10003 | 60.0 | 27 | 13.7 | 13.0 | 71.1 | .49 | 61 | 2.14 | 4.3 | 1 | 832 | 77 | 89 | 854 |
| Lee | 9 | 12488 | 60.5 | 30 | 15.0 | 14.0 | 70.0 | .48 | 62 | 2.22 | 4.2 | 1 | 860 | 89 | 93 | 907 |
| Selkirk | 9 | 13100 | 59.4 | 31 | 13.9 | 13.1 | 74.3 | .48 | 62 | 2.19 | 4.3 | 2 | 846 | 83 | 92 | 860 |
| Conley | 9 | 13157 | 59.7 | 29 | 14.2 | 13.3 | 71.7 | .46 | 63 | 2.08 | 4.5 | 2 | 850 | 86 | 93 | 871 |
| 1953 x Lee | 1 | 13242 | 60.0 | 30 | 15.2 | 14.3 | 72.9 | .39 | 63 | 2.00 | 4.8 | 2 | 835 | 85 | 95 | 920 |
| Thatcher | 1 | 10003 | 60.1 | 29 | 16.2 | 15.6 | 75.3 | .54 | 65 | 2.00 | 4.3 | 1 | 925 | 75 | 95 | 985 |
| Lee | 1 | 12488 | 60.2 | 31 | 16.5 | 15.7 | 76.6 | .56 | 66 | 2.25 | 4.2 | 1 | 968 | 80 | 90 | 990 |
| Selkirk | 1 | 13100 | 58.8 | 30 | 15.4 | 14.5 | 76.4 | .50 | 63 | 2.00 | 4.5 | 2 | 865 | 90 | 95 | 930 |
| Conley | 1 | 13157 | 57.6 | 31 | 16.2 | 15.6 | 73.2 | .44 | 65 | 2.25 | 4.4 | 2 | 930 | 90 | 100 | 985 |
| Rescue x 1831 | 2 | 13304 | 61.2 | 30 | 15.1 | 14.7 | 76.4 | .50 | 65 | 2.13 | 4.4 | 1 | 933 | 75 | 85 | 940 |
| Thatcher | 2 | 10003 | 60.2 | 29 | 16.0 | 15.2 | 74.9 | .48 | 65 | 2.00 | 4.4 | 1 | 932 | 78 | 95 | 968 |
| Rescue | 2 | 12435 | 59.9 | 32 | 15.8 | 15.0 | 74.2 | .44 | 61 | 2.12 | 4.6 | 2 | 930 | 75 | 92 | 958 |

## 1953 x Lee (C.I. 13242)

Tests made on a single sample of 1953 x Lee show that it had satisfactory milling properties but produced a lower yield of flour in comparison to the four approved hard red spring wheats included as standards of comparison. It was equal to or higher in test weight per bushel than Thatcher, Lee, Selkirk, or Conley. Strain 1953 x Lee does not seem to be as strong as the four approved varieties compared with it. It is more nearly comparable in quality to Selkirk than to the other three varieties in wheat and flour protein content, water absorption, mixing time, specific sedimentation value, bromate requirement, loaf volume and bread crumb characteristics. It is lower in flour protein content than Thatcher, Lee, and Conley which accounts in part for its slightly lower loaf volume. It is of interest to note the unusually low ash content of this strain but due to the fact that only one sample of this wheat was tested this result might be questionable. However, Conley was also low in flour ash content. This strain is lower in flour yield than comparable grown Thatcher, Lee, and Selkirk but similar again to that of Conley. A moderately strong dough with elastic, pliable properties produced a loaf of bread comparable to those produced by approved hard red spring varieties.

## Rescue x 1831 (C.I. 13304)

Comparable milling and baking tests show this strain to be about equal to Thatcher and Rescue in many quality characteristics. Rescue x 1831 produced a loaf of bread equal in volume and crumb characteristics to those of Thatcher and Rescue. The milling properties of this strain were found to be exceptionally good. The dough handling properties were strong and elastic. Good test weight, flour yield, water absorption, mixing time, loaf volume, and crumb grain make this a promising bread wheat. Minor detrimental factors are a slightly high ash, and a slight yellowness in crumb color. This strain is similar in most respects to its parent Rescue insofar as comparisons could be made on only two samples of this wheat received for testing this year.

MISSING: 1959